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SAFETY AWARENESS USING A COMPUTER-BASED SAFETY TRAINING AT SEMICONDUCTOR INDUSTRY

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ABSTRACT

The computer-based safety training (CBT) system was developed for the use in a semiconductor industry. The component of the CBT includes user interface, database management system, knowledge base and inference engine. This system has two main sections which are safety theory modules and accident prevention scenarios. The application of CBT was tested at the semiconductor industry. The analysis on the developed system revealed that more than 86% of the respondents have successfully increased their safety awareness and understanding towards safety at the workplace after went through the SLK system.

Key Words: Safety Awareness; Computer-based Training (CBT); Safety Training; Semiconductor Industry

1.0 INTRODUCTION

Effective occupational, safety and health management and its relation with productivity is considered as an important element when managing the interaction between system and people [1]. Human factors play a significant role in the safety performance of organizations. The unsafe behaviour adopted by human can lead to accidents [1]. Therefore, safety programme must be designed to accomplish their purpose in two primary ways: focusing on unsafe employee action and the other on unsafe working conditions [2].

Training is a major endeavor in all-modern professional practices [3]. The evident is clearly indicated that well-trained and careful worker may avoid injury on dangerous work and untrained and careless workers may be injured under the safest possible conditions [4]. The safety training is intended to ensure that employees perform their jobs properly, thus promoting safety and increasing productivity.

Now a day, almost all trainings are delivered via CD-ROMs, intranets or the internet rather than the conventional method (formal class, training manual and on-the-job training). Interactive computer programmes for training can reduce long-term training costs and training time for learners [5]. These systems also have several added strength such as efficient, low cost relative to on-the-job training, supports course management, and more convenience for instructional delivery than lecture [3, 6-8].

The objectives of this study are do determine the following :

a) Employees' perception on the developed computer-based safety training system
b) Employees' awareness towards safety in work place

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2.0 METHODOLOGY

2.1 Development of Computer-based Safety Training System

The system has two main sections which are the safety theory modules and accident prevention scenarios. As per discussion with health, safety and environment personnel, three basic safety theory modules were developed including the quiz of every module. The modules are:

a) Ergonomics
b) Personal Protective Equipment (PPE)
c) Material Safety Data Sheet (MSDS)

Trainees will select any module they like and the system will guide them through with the training. Then, they choose whether they want to continue with the quiz or another module. If they choose the quiz module, they must get a minimum score of 90% before they can proceed to another module. Failing to obtain a score of 90 % will require them to repeat the module and quiz or quit the system.

In the accident prevention part, 14 accident scenarios have been developed to test the employees understanding towards safety at workplace. The scenarios are related to the semiconductor industry and safety theory module (ergonomics and personal protective equipment), such as chemical handling, back injuries, musculoskeletal injuries and did not wear an appropriate PPE.

2.2 Case Study

The safety knowledge test was conducted to verify the usefulness and effectiveness of the developed system to the selected semiconductor employees. The employees were tested on their knowledge of the safety procedures and industrial working practices before and after they used the system. The questionnaire is divided into 2 parts which are safety theory and accident scenario. 30 respondents participated in this safety knowledge test. The data was analysed based on the percentages of respondents' score in safety knowledge test before and after they used the system.

3.0 RESULTS AND DISCUSSION

3.1 Computer-based Safety Training System

Computer-based safety training was developed using a web-based application. It is called "Sistem Latihan Keselamatan Berasaskan Komputer" (SLK). The system is divided into two parts, the safety theory module and the accident prevention scenario. The system consists of 3 safety theory modules. The modules are:

a) Ergonomics
b) Personal Protective Equipment (PPE)
c) Material Safety Data Sheet (MSDS)

SAFETY AWARENESS USING A COMPUTER-BASED SAFETY

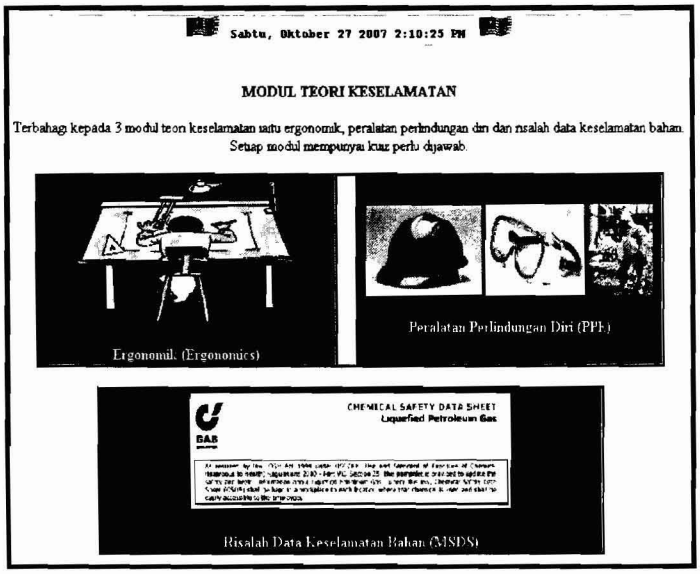

Figure 1 Safety Theory Module Options

Ergonomics is commonly thought of as how companies design tasks and work areas to maximize the efficiency and quality of their employees' work. The goal of ergonomics is to make the interaction of humans with machines as smooth as possible, enhancing performance, reducing errors, and increasing user satisfaction through comfort and aesthetics. The main topics are introduction to ergonomics at workplace, ergonomics awareness and quiz.

Personal protective equipment, or PPE, is designed to protect employees from health and safety hazards that cannot be practically removed from their work environment. Personal protective equipment is designed to protect many parts of their body including eyes, face, head, hands, feet, respirator system and ears. The module is divided into 3 parts which are introduction to personal protective equipment, understanding personal protective equipment and quiz.

A material safety data sheet (MSDS) is a form containing data regarding the properties of a particular substance. An important component of product stewardship and workplace safety, it is intended to provide workers and emergency personnel with procedures for handling or working with that substance in a safe manner. The MSDS module is divided into 5 parts which are introduction to MSDS, understanding chemical exposure, understanding MSDS, list of MSDS and quiz. Detailed information of a chemical is shown which the physical and chemical properties, physical are and health hazards, routes of exposure, precautions for safe handling and use, emergency and first-aid procedures, control measures and others.

In the accident prevention parts, 14 types of accident scenarios were developed. The scenarios are related to the semiconductor industry and safety theory module (ergonomics and personal protective equipment) such as chemical handling, back injuries, musculoskeletal injuries, not wearing the specific PPE and etc. The test takes about 10 to 20 minutes per scenario to complete.

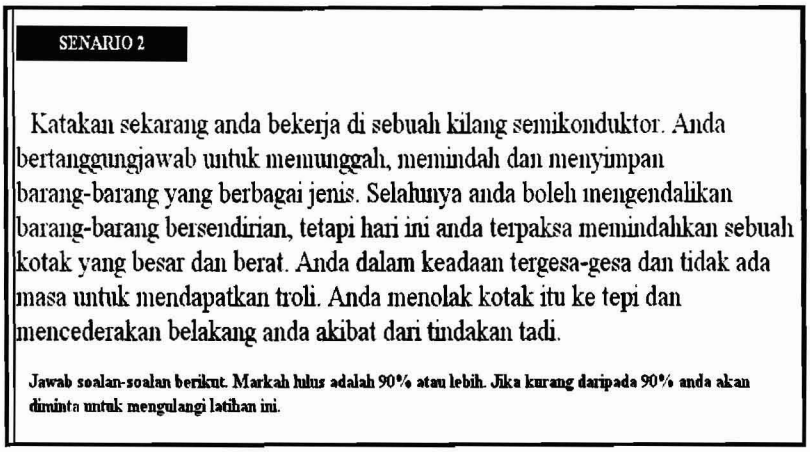

Figure 2 Example of Accident Prevention Scenarios

3.2 Safety Knowledge Test

The safety knowledge test was conducted to verify the usefulness and effectiveness of the developed system to the selected semiconductor employees. The employees were tested on their knowledge of the safety procedures and industrial working practices before and after they used the SLK system. The questionnaire was divided into 2 parts which are safety theory and accident scenario. The test took about 15 to 30 minutes to complete and 30 respondents participated in this test.

The findings show that 26 of 30 respondents (86.7 %) have an increase in their scores. The highest increment was about 46 % and the lowest was around 8 %. This situation proved that the respondents have better understanding towards safety at workplace after going through the SLK system. The total average of the increment was about 20 %.

4.0 CONCLUSIONS

In conclusion, computer-based safety training system such as SLK system is a very practical tool in the selected semiconductor industry and has successfully increased the awareness of safety procedures as well as the understanding of good working practices. It is proven by the result of safety knowledge test in which 86.7 % of the respondents have successfully increased their safety awareness and understanding towards safety at workplace after going through the SLK system. Similar system can also be used at other organization with little modifications to suit the working environment and job description of the specific industry.

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REFERENCES

[1] Ali, H., N.A.Chew Abdullah, and C .Subramaniam, C. 2003. Embracing Safety Culture to Enhance Organizational Safety Performance, *Proceedings of the National Occupational Safety and Health Conference on Promoting Excellent OSH Culture: A Source for Competitive Advantage,* April 21- 23. UUM: School of Management, UUM, 2003.256-260.

[2] Hin. C. W. 2003. Application of the Total Quality Management Principles in the Training and Educating of Occupational Safety and Health for Employees, *Proceedings of the National Occupational Safety and Health Conference on Promoting Excellent OSH*

Culture: A Source for Competitive Advantage, April 21-23, UUM: School of Management. 105-110.

[3] Farias, A. and N. Arvanitis. 1997. Building Software Agents for Training Systems: A Case Study on Radiotherapy Treatment Planning, *Journal of Knowledge-based System* 10: 161-168.

[4] Heinrich, H. W., D. Petersen, and N. Roos.1980. *Industrial Accident Prevention: A Safety Management Approach*, United States of America, McGraw-Hill, Inc.

[5] Kraiger, K. 2002. *Creating, Implementing and Managing Effectiveness Training and Development*, San Francisco: Jossey-Bass.

[6] Ramachandran, P. and V.A. Zaloon.1996. A Computer-based Training System for Process Safety Management, *Journal of Computer in Education*. 31: 511-513.

[7] Saoud, E. A. B. 1996. *Expert Systems for Management Training in the Construction Industry*,University of Edinburgh: PhD Thesis.

[8] Stone, R. 2001. Virtual Reality for Interactive Training: An Industrial Practitioner's Viewpoint, *Journal of Human-Computer Studies*. 55: 699-711.